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# **SOCIOECONOMIC AND LAND VALUE IMPACT OF URBAN FREEWAYS IN ARIZONA**

**Final Report**

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## 1.0 Introduction

This section provides an overview of the study, a summary of major findings, and describes the report organization.

### 1.1 Overview

This report includes two lines of research on the impact of urban freeways. The first objective of this study is to identify patterns of socioeconomic change that might accompany the development of new urban freeways in Arizona. As identified by the Arizona Department of Transportation, these socioeconomic patterns include:

1. Property values of land immediately adjacent to and contained within the corridors paralleling freeway development.
2. Land use patterns at major intersections and along freeway routes.
3. Industrial, office, and commercial development patterns generated by freeway construction.
4. Altered urban growth patterns created by freeway construction and attendant improvement in access to employment centers.
5. Attitudes of the population concerning their living environment and the relationship between improved transportation facilities and their own well-being.

The focus for most of the study is on the historical assessment of the actual changes and impacts that have occurred within Arizona as a result of urban freeways. This was based on a careful review of previous research and on other case studies.

The second line of research is to evaluate the effect upon land prices of an announcement of freeway construction. Based on land sales transactions between 1983 to 1987 recorded by the Maricopa County Assessor's Office, the effect of freeway announcement on land within a mile of the freeway alignment was distinguished from land outside the proposed freeway corridor.

### Methodology

The socioeconomic case studies were performed on the Black Canyon Corridor from McDowell Avenue on the south to Bell Road on the north, and on the Superstition Corridor from I-10 on the west to Gilbert Road on the east. These corridors are in



three cities--Phoenix, Tempe, and Mesa. Within each of those corridors, two smaller (nine square mile) areas were selected for detailed analysis--the Black Canyon Study Area from McDowell to Camelback, and the Superstition Study Area from Mill Avenue to Price Road. In the Study Areas, control areas that were similar to freeway corridor development were also studied in depth, in order to better isolate freeway impacts.

Several information sources were used to reconstruct the historical impact of the freeways.

- Aerial photographs and zoning maps
- Census data
- Property valuation and sales transactions records of the Maricopa County Assessor's Office
- Planning documents
- Telephone survey
- Key informant interviews

The land value analyses were conducted on the Estrella Freeway, Sun Valley Parkway, South Mountain Freeway, Agua Fria Freeway, San Tan Freeway, Superstition Freeway, and Papago Freeway corridors.

#### Analytic Perspective

Figure 2-1 in Chapter 2.0 presents a model of the interaction between freeways and market forces. The market responds to urban freeway changes as well as other events affecting market demand. Each segment of the market weighs the economic advantages and disadvantages of the new freeway. If the change in the conditions is significant enough to cause a change in behavior, then changes in the market should occur. The most obvious change should be in land prices along the freeway corridor. Classic land use theory tells us that different land uses are in competition with one another for locations that meet their particular criteria. The land use that is both capable and willing to pay the most for a specific location should be able to locate in the area of choice. Since the new urban freeway has upset the market equilibrium that existed due to changes in accessibility, relative land prices will change, which should result in different land uses and development intensities than would have occurred if the freeway had not been built.

Local government response to a new urban freeway, either proactive or reactive, can affect the market response dramatically. This response is conveyed both through

local zoning and land use planning, and through the timing of public infrastructure development along the freeway route.

Generally, urban functions that make the most intensive use of the land are able to generate the greatest income. Therefore, given both locational requirements and ability to generate income, it is possible to predict idealized land use patterns along freeway corridors. These are illustrated in Figure 2-2 in Chapter 2.0. The case studies were performed using the construct of this analytic model.

The next section summarizes the conclusions and major findings of the case studies.

## 1.2 Major Findings

The strongest and most obvious conclusion about the historic socioeconomic impact of freeways in metro Phoenix is that freeways are a necessary but not sufficient cause for development to occur.

- Other factors are equally as important, including municipal planning and zoning, land availability, existing utilities and infrastructure, and other transportation modes--railroads and arterials in the case studies and, presumably, airports, and general development trends.
- Freeways merely create a condition that improves the market opportunity for change.
- More importantly, development around freeways can be controlled by strong urban land use planning.
- However, it is clear that income-generating properties--non-residential uses and apartments--have strong locational preferences for freeway corridors.
- In the absence of strong planning, private development will guide the freeway's development.

A secondary conclusion is that income-generating properties locate in freeway corridors, like classic land use theory predicts.

- Moreover, freeway intersections are most likely to be developed into non-residential activities.

- However, residential developments are the predominant corridor activity-- 60 percent of the Black Canyon's and 75 percent of the Superstition Corridor's inventory.

A third conclusion is that the intensity of freeway corridor development depends on a combination of macroeconomic demand conditions and the supply of developable land.

- The case of the Superstition Corridor and the urban form analysis demonstrates that one of the most important effects of freeways is the development of the urban fringe that is caused by freeway accessibility.
- Compared to that effect, there is a surprising amount of undeveloped land which exists in the corridors themselves, especially those on the fringes.
- The expansion of the urban freeway system from approximately 80 miles to over 200 miles will certainly accelerate accessibility to more remote fringes, while it will create an oversupply of corridor land.

Beyond these broad statements, the specific kinds of land uses and their locations are very much dependent on the peculiarities of place--existing land uses, existing zoning, etc. Combined with the finding that strong urban planning can control growth leads us to an optimistic conclusion: local residents can actively control land development in their neighborhoods, if city government cooperates with them.

If market pressures are accounted for, however, the Black Canyon and Superstition Area socioeconomic case studies have demonstrated that the life of quality residential neighborhoods extends far beyond freeway completion. What seems to be necessary is that quality residential neighborhoods need to be supported by complementary land uses and strong freeway design features. In particular, these include:

- Parks and schools, which are very important supporting land uses;
- Supporting freeway features that include the depressed freeway design, supplemented by ample right-of-way, walls that are high enough to contain noise, and features like pedestrian walkways to keep residential neighborhoods from becoming isolated from supporting land uses; and
- Classic land planning that buffers single family development from arterials and freeways by multifamily and non-residential uses.

In the Superstition Study Area, where this combination of design and land planning was implemented, the rate of appreciation for single family property values for houses closer than one-half mile to the freeway actually was greater than similar homes in a control area beyond one-half mile of the freeway. Although there were too few sales transactions for smaller zones to be entirely confident of the information, the appreciation rate of houses closer than 600 feet to the freeway was also greater than for similar houses in the control area.

Regarding the land value/freeway announcement analysis, the conclusion is that land values in proposed freeway corridors have increased due to freeway alignment announcements.

- In all freeway corridors, the rate of land appreciation was substantially higher after freeway announcement, compared to its rate prior to announcement.
- The average monthly rate of sales value appreciation before the freeway announcement was virtually identical for impact zones and control areas-- 1.9 percent and 1.92 percent, respectively. After the freeway announcement, the average monthly appreciation was 3.77 percent in control areas and 6.67 percent in impact zones.
- Thus, within the freeway corridor, land prices trebled because of the freeway announcement.

Beyond these conclusions are the findings which support them.

#### Residential Property Values

- Residential property values from 1972 to 1987 were tracked in the Superstition Study Area.
- Values increased for all properties that were surveyed, both in the Control Area and the Impact Area.
- Within the Impact Area, there does not appear to be a correlation by distance.
- The rate of appreciation immediately after the freeway's construction was faster for the Study Area than for the metro average for a five-year period. It is possible this was due to increased freeway accessibility.

- After the freeway had been in place for five years, the rate of appreciation was about the same for the Study Area as for the larger North Tempe area in which it is included.
- In that later period, the rate of appreciation was faster for properties in the freeway impact zone than in the Control Area. In fact, Impact Area properties appreciated faster than the North Tempe average.
- The Superstition Study Area is a residential development that is supported by complementary land uses and by beneficial freeway design and other features.

### Residential Attitudes

- Homeowners who moved to the Study Area before the Superstition was built did so because of the house and the neighborhood. Homeowners who moved after the freeway was built did so because of the neighborhood, because of freeway accessibility, and because of price.
- Accessibility is perceived to be the most positive freeway impact.
- Overall, 76 percent of homeowners considered the overall impact of the freeway on their lives as very good. By distance, the lowest positive response is 64 percent.
- Ninety percent of homeowners who moved to the area after the freeway was built thought its impact was positive.
- The majority of homeowners who lived more than 200 feet from the freeway would again buy a home as close to a freeway. Only 21 percent who lived within 200 feet would do so.
- People who live within 600 feet of the freeway are most uncertain about its property value effect. The further away people live, the more they believe the freeway has no effect.
- Moreover, people who live close to the freeway are preoccupied with its effect in their property's value. After 600 feet, homeowners are more realistic about other factors that affect property value.

### Role of Municipal Planning

Between their alignment in urbanized and undeveloped areas and their alignment across several jurisdictions, each of which approached land use planning differently, the Black Canyon and Superstition Study Corridors provide very different case studies.

- The Black Canyon Study Area (from McDowell to Camelback) and, to a lesser extent, the South Black Canyon Corridor from McDowell to Northern Avenue are case studies in already urbanized areas, without a general plan accounting for freeways.
- The North Black Canyon Corridor is a case study of an undeveloped area, but one guided by a stronger general plan that contains sensible uses for freeway corridors.
- The Superstition Study Area and the Tempe Superstition Corridor are case studies in developing, but not completely urbanized, areas guided by a strong general plan, but one which, essentially, ignores the freeway.
- The Mesa Study Corridor is a case study in an undeveloped area guided more by the private market than by public planning.

Tempe's implementation of a plan which successfully developed the Superstition Corridor into proportionately more residential land uses than might be expected illustrates the very strong role that local governments can take in controlling freeway development. In contrast, it appears that Mesa did not have an integrated concept of the Superstition Corridor in relation to the rest of the city. Without a strong general plan context, incremental rezoning requests were prevalent. Thus, the corridor developed according to market forces which followed classic locational requirements. The Phoenix case is less clear, but it appears that the 1969 plan was implemented in the undeveloped North Black Canyon Corridor, probably because the plan followed classic locational requirements, thus anticipating the market.

As a detailed analysis of the Phoenix area corridors' development between 1959 and 1987 shows (Chapter 8.0), at a macroscopic scale classic locational requirements prevail rather strongly. However, the case study of general plans demonstrates that a clear vision of development as articulated in a general plan and in policy can result in development that is different than what pure market forces would have determined.

#### Land Use Impacts In Study Areas

- Both the Black Canyon and Superstition areas developed quickly after completion of the freeways.
- The influence of Encanto Park and Cielito Park in the Black Canyon area has influenced the stability of residential neighborhoods that surround it.
- The rapid industrial development of the western Black Canyon area is due more to the compilation of zoning, rail proximity, and available land with

utilities in place with the Black Canyon Freeway than to the freeway alone.

- Over a long period, from 1959 to 1987, residential density has increased with the encroachment of multifamily, especially along freeway and arterial corridors.
- Tempe's will to implement the 1967 General Plan, combined with a beneficial freeway design, has resulted in stable residential development along the Superstition Corridor.
- The placement of land uses in the Superstition area supports residential development. Like the Black Canyon, single family residential areas are supported by parks and schools. Non-residential activities are mainly clustered at arterial intersections, and industrial development is separated from any residential area by an arterial.
- Still, over time, the Superstition area has evolved into higher density uses. In part, this is from later development of non-residential activities. However, in the Impact Area and the older North Control Area, multifamily development has occurred, even displacing some single family residential.

#### Non-Residential Impacts in Study Areas

- The Black Canyon area is predominantly industrial, while the Superstition area is predominantly residential.
- The rate of non-residential development in the Black Canyon area grew at an annual 7 percent compound growth rate for almost a twenty-year period after the freeway's completion.
- In the Black Canyon, those areas which grew the most intensely combined favorable zoning, land and utility availability, and a mix of transportation nodes to develop into a large industrial center.
- Retail and office development in the Black Canyon are secondary developments.
- The Superstition area's non-residential development is primarily retail, both neighborhood and community center scale. This is not surprising for a primarily residential area.
- The Superstition's rapid non-residential development period lasted only twelve years, but over that time its growth rate was from 16 to 23 percent.
- Office development, mainly inside the freeway corridor, was strongest six years after the freeway was completed.
- Combining the two Study Areas, it is clear that freeways have stimulated non-residential growth in both cases.



- However, the freeway's presence is only a contributing factor to the precise location of non-residential development. Equally important are municipal planning and zoning, available land, utilities, and infrastructure, and other transportation nodes.

### Corridor Development

The corridor analysis has produced some important findings, which follow according to the major questions that the analysis was designed to answer.

1. **To what extent has actual corridor development followed market-based land use theory?**
  - Freeway study corridors contain a larger share of income-generating properties, and the two "undeveloped" corridors, where the market was freer to develop, contain an even larger share.
  - Two corridors were already urbanized before freeway development, and both contain more extreme land use distributions, but for different reasons. Tempe's is because of municipal planning and the South Black Canyon's is because of previously existing locational attributes and site characteristics.
  - The two "undeveloped corridors" are the most similar pair among study corridors, including their share of income-generating uses.
  - Non-residential development within freeway corridors grew much faster than other kinds of development, and grew faster than metrowide non-residential development.
  - Inside freeway corridors, the growth rate for property that does not generate income was half the rate of other land uses.
2. **How strongly does municipal planning affect corridor development?**
  - Only 29 percent of corridor uses in the Tempe Superstition Corridor, which Tempe planned for residential, are income-generating properties.
  - Although each of the corridors are dissimilar in land use details, the Tempe corridor stands out in uniqueness in all areas--along its length, at intersections, within inner corridors, and within outer corridors.
3. **Do subareas of the corridor develop differently?**
  - Income-generating properties are 66 percent of all uses at intersections, 51 percent of all uses at inner corridors, and only 45 percent of all uses in outer corridors.

- Within study corridors, outer corridors developed more quickly at first, followed by inner corridors and then intersections. This is especially true of residential development.
  - Non-residential inventory develop earliest at intersections, then inner corridors and then outer corridors.
4. In previously undeveloped areas, have freeway corridors developed at different rates, magnitudes, and uses?
- Comparatively, the two previously undeveloped corridors--the North Black Canyon and the Mesa Superstition--look more alike than any other pair of study corridors.
  - The large amount of undeveloped land within corridors is surprising, given the short supply of freeway corridor land in metro Phoenix.
    - In 1975, twelve years after freeway completion, about 30 percent of the South Black Canyon Corridor north of Bethany Home Road was undeveloped.
    - In 1987, 22 years after freeway completion, 25 percent of the North Black Canyon's land area is still undeveloped.
    - Six years after freeway completion, 30 percent of the Mesa Superstition Corridor is undeveloped.
    - The Tempe Superstition is an exception. In 1975, when the freeway was completed, about 40 percent of the corridor was undeveloped. In 1987, only small infill pockets and industrial land were vacant.
  - Regional malls have been early activities which led development in the North Black Canyon and Mesa Superstition Corridors.
  - A large amount of residential development has also been an early activity in the two "undeveloped" corridors.
  - "Undeveloped" corridors have grown more rapidly than "developed" corridors, but no more rapidly than the entire metro area since 1975.
  - Non-residential development in "undeveloped" corridors is much more rapid than in any other area.
5. How strongly do freeway corridors attract the several kinds of land uses?
- The rate of development for office, hotel, and apartment uses is much faster within corridors than in other areas.
  - Freeway attraction for industrial development is not as clear. Its rate is slower than other areas for "developed" corridors but faster for "undeveloped" corridors. Its growth rate was not as fast in corridors than in other non-residential uses.

- The growth rate for retail and single family/townhouse inventory inside corridors was half the rate of other land uses.
- Single family development is a large part of freeway corridor development. Almost 70 percent of the inventory in the study corridor is single family development. Even discounting the Tempe Superstition area, single family inventory is still almost 50 percent of the inventory in each of the remaining three corridors.

### Urban Form Impacts

- From the research conducted in other areas and based on urban growth theories, the importance of major transportation systems in general, and urban freeways in particular, is known. Everything else equal, a commercial site with freeway access and visibility will be preferable over a site that lacks the freeway frontage.
- In addressing the urban form question, the difficulty is in quantifying the potential impact of urban freeways. Although the impacts can be described in concept, it is difficult to predict what the form of the metro area would be if the urban freeway system would have been developed differently.
- The shape of the metro area urban form in 1953 before any urban freeways had been built shows some correspondence between the major highway system and development patterns.
- The development pattern in 1983 appears to be strongly correlated to the major transportation routes within the metro area. In particular, substantial development has occurred along the North Black Canyon and along the Superstition Corridor. Little change is evident along the Papago Corridor.
- The development of the Papago in the late 1950s would have likely resulted in extensive industrial and residential development on the west side.

### Land Sales/Freeway Announcement Effects

- The analysis used Maricopa County Assessor's records to track land sales before and after freeway announcements in five freeway corridors. "Impact Zones" within a mile of the corridor were distinguished from control areas.
- Of these corridors, there were a sufficient number of records in from freeway corridors to complete the statistical analysis.
- The following table shows the monthly sales appreciation rate for each corridor and for the average.

### Monthly Land Sales Appreciation

	<u>Before Announcement</u>		<u>After Announcement</u>	
	Control	Impact	Control	Impact
Estrella	3.33%	3.07%	2.60%	4.65%
Sun Valley	1.44%	1.88%	6.85%	6.57%
Agua Fria	0.60%	0.10%	1.24%	1.52%
San Tan	2.30%	2.91%	4.37%	13.92%
AVERAGE	1.92%	1.99%	3.77%	6.67%

Source: Mountain West Research.

### 1.3 Report Organization

This report contains eleven major sections.

- Chapter 2.0 provides a theoretical context supported by other case studies in the literature.
- Chapter 3.0 orients the reader to Study Area definitions and descriptions.
- Chapter 4.0 provides the institutional context--the county's rapid growth, the timing of the freeways' construction, and municipal planning reactions to the freeways that directed the development of corridors.
- Chapters 5.0, 6.0, and 7.0 provide detailed case studies on the two nine-square mile Study Areas, distinguishing between an Impact Area contained in the freeway corridor, and Control Areas that are similar but further away.
  - Chapter 5.0 presents demographic and land use impacts.
  - Chapter 6.0 presents residential impacts, particularly the property value analysis and the attitudinal survey.
  - Chapter 7.0 presents non-residential impacts.
- Chapter 8.0 presents impacts on the longer freeway corridors.
- Chapter 9 discusses urban form impacts.
- Chapter 10 presents the land value/freeway announcement analysis.
- Chapter 11 presents conclusions and recommendations for further research.

## **2.0 Introduction to the Socioeconomic Impacts of Urban Freeways**

### **2.1 Overview**

The social and economic impacts resulting from freeway construction have been a routine part of project planning and development for many years. These studies usually concentrate on the direct social and economic effects of a project as expressed in terms of population or employment change or some other measure of direct impact. A typical impact associated with highway construction, for example, is the potential business loss due to a new highway project that takes traffic around a rural community rather than through the business district.

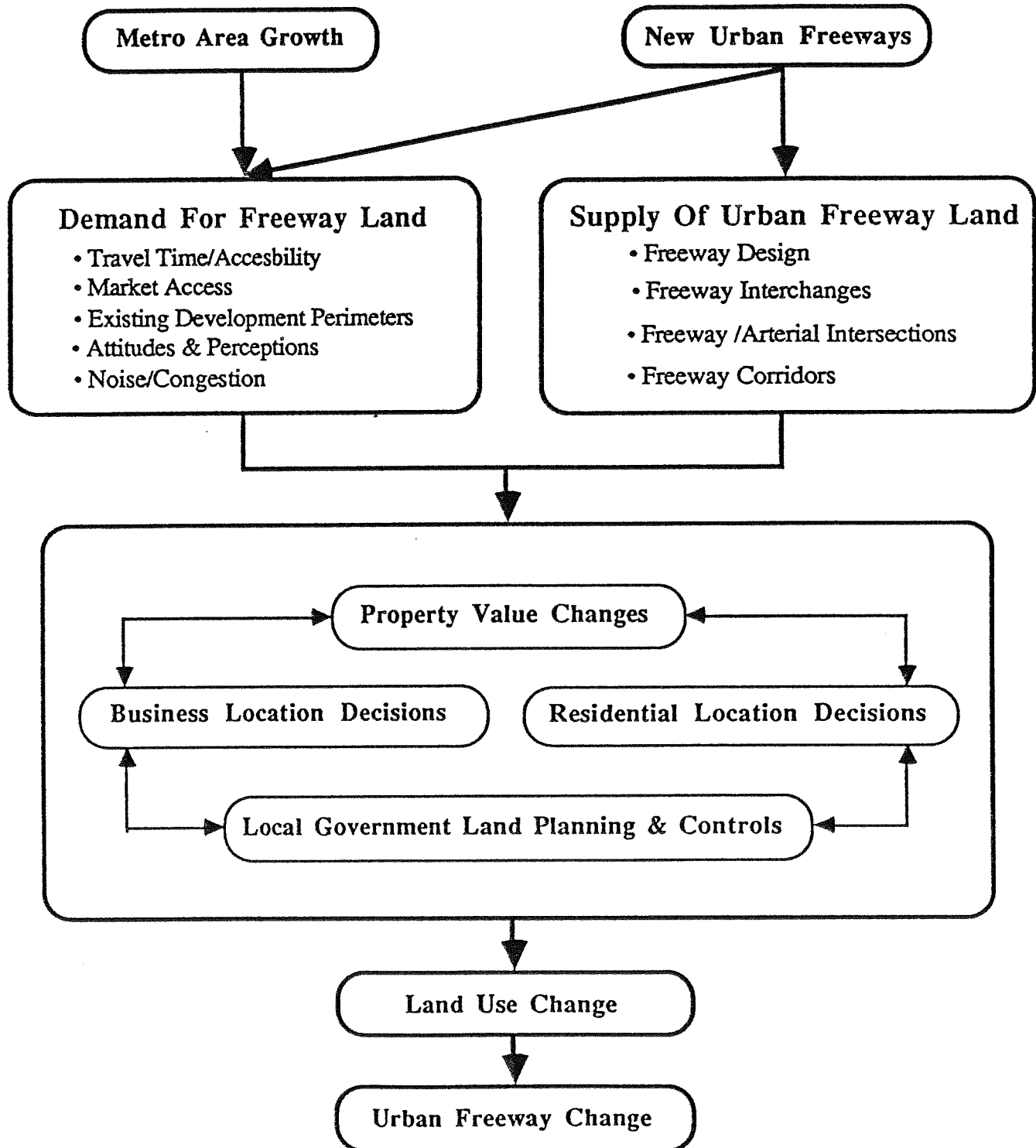
Although such studies have been routinely completed as part of urban freeway planning, the indirect impacts are often not fully considered. This may be largely due to the fact that many of these indirect impacts are difficult to measure. Unlike the measurement of business loss due to the construction of a highway bypass, many of the indirect impacts of urban freeways, such as land use change, are much more elusive. Although we know what the land use is after the urban freeway is in place, we can only speculate as to what the land use would have been if the freeway had not been built.

The major analysis question that arises in examining the indirect impacts is the question of attribution. In the case of the highway bypass around the rural community, a direct correlation can be drawn from the event (the construction of the bypass) to the impact (the loss of business in the community). The connection between the event and the impact in the case of urban freeways is not as clear.

The introduction of a freeway system within an urban area changes the economic equilibrium in both the business and residential segments of the community. The transportation cost structure is changed dramatically, either in terms of actual dollars or travel times, and the definition of market areas and labor sheds are modified.

Figure 2-1 presents a model of the interaction between freeways and market forces. The market responds to urban freeway changes as well as other events affecting market demand. Each segment of the market weighs the economic advantages and disadvantages of the new freeway. If the change in the conditions is significant

**FIGURE 2-1**  
**THEORETICAL MODEL**  
**OF FREEWAYS, MARKET FORCES,**  
**LOCAL GOVERNMENT CONTROL AND LAND DEVELOPMENT**



enough to cause a change in behavior, then changes in the market should occur. The most obvious change should be in land prices along the freeway corridor. If the freeway has improved the accessibility of a given location to a greater number of customers for a certain retailer, for example, then that retailer should be able and willing to pay more for land. Classic land use theory tells us that different land uses are in competition with one another for locations that meet their particular criteria. The land use that is both capable and willing to pay the most for a specific location should be able to locate in the area of choice. Since the new urban freeway has upset the market equilibrium that existed due to changes in accessibility, relative land prices will change, which should result in different land uses and development intensities than would have occurred if the freeway had not been built.

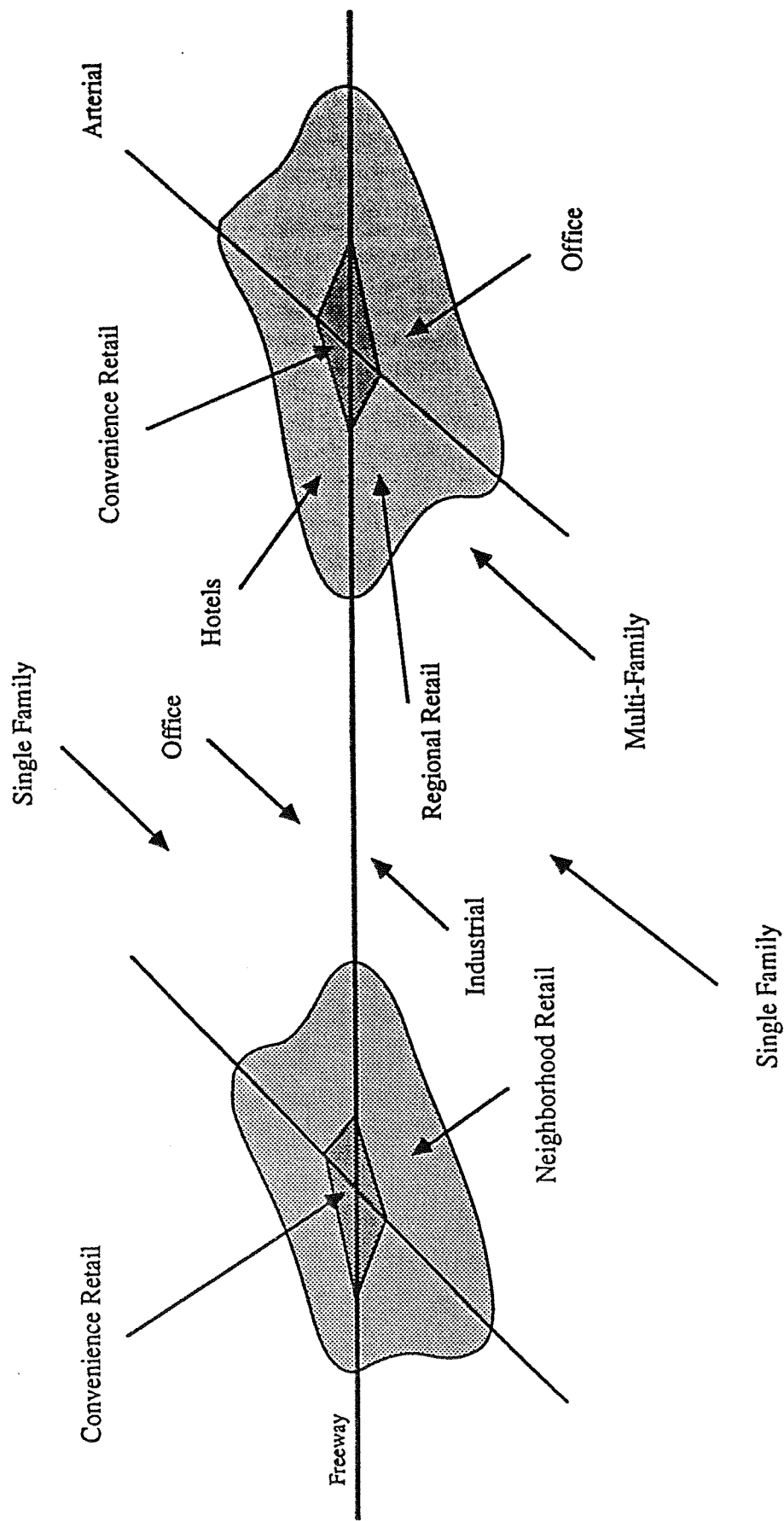
Local government response to a new urban freeway, either proactive or reactive, can affect the market response dramatically. This response is conveyed both through local zoning and land use planning, and through the timing of public infrastructure development along the freeway route.

Generally, urban functions that make the most intensive use of the land are able to generate the greatest income. Therefore, given both locational requirements and ability to generate income, it is possible to predict idealized land use patterns along freeway corridors (see Figure 2-2).

- Freeway interchange areas are typically the most economically desirable pieces of real estate along freeways due to their "focusing effect," i.e., limited areas for freeway entry and exit produce maximum visual exposure and potential vehicular accessibility, therefore making them the most attractive area for development by activities that capitalize on those benefits.
  - Regional and community shopping centers, for example, will tend to locate in the areas just beyond the interchanges because of their accessibility and visibility requirements, as well as their ability to generate income.
  - Neighborhood shopping facilities and convenience commercial developments also tend to locate adjacent to the freeway interchanges for similar reasons, albeit on a smaller scale and to a lesser degree.
- Hotels and motels, on the other hand, generally gravitate toward airports, at interchanges along major interstate routes, and in areas where two freeways intersect, particularly in areas close to major employment centers.



FIGURE 2-2  
IDEAL LAND USE PATTERNS ALONG A FREEWAY



- Office complexes are typically found throughout the freeway corridor. They often fill in the gaps of land between interchanges that are not highly desired by commercial developments.
- Condominium, townhouse, and apartment complexes are usually developed along arterials off of freeway interchanges, just beyond retail and office uses. These developments are compatible with retail and office functions.
- Single family residential areas are repelled from direct contact with freeway interchange uses. If freeways are located too closely to them, problems like noise, will often create problems, both real and perceived. The actual magnitude problems are greatly influenced by the physical design of the freeway. Single family residential uses are not ideal freeway corridor developments unless nuisance mitigation measures are implemented.
- Industrial uses are usually located on land along the freeway routes that are not desired by higher commercial uses, i.e., stretches between interchanges.

These are generalized land use patterns. There are a number of local factors that will distort this idealized land use pattern.

- The development of land along freeways is dependent upon local supply and demand conditions. One of the factors that influence this situation is the metro area's economic base. For example, if the economic base is predominantly business service oriented, then demand for office uses will be higher than, say, industrial uses.
- Another factor influencing land development patterns along freeway corridors is the supply of corridor land relative to demand for corridor land.
  - If there is a limited amount of developable land adjacent to freeways and the local economy is highly successful in business development, it is likely that the freeway corridor will be put into the highest and best use. This has been metro Phoenix's condition to date.
  - However, if the supply of developable freeway-adjacent land is high and the demand is low, large areas of the freeway corridor, except perhaps on the interchange, will probably remain vacant until the demand for land "catches up" with the supply.
- The specific impacts freeway development have on surrounding land uses obviously depend on whether the area is already developed or not.
  - If the area is already developed (i.e., urbanized), then the freeway will not have as dramatic an impact on land use in comparison to an undeveloped area. While there may be both clearance and displacement in the freeway right-of-way and some redevelopment opportunities, the existing developments adjacent to the alignment will, for the most part, remain in place.

- In areas where there are vacant parcels in an otherwise developed area, there may be infill development like multifamily housing or neighborhood retail uses.
- The final major factor influencing actual development patterns is the local government responsible for land use planning. The selection of a new freeway route often prompts the review and possible revision of a city's General Plan. Local governments may want to slow down freeway corridor development because they want to encourage development in other areas they deem of more strategic importance to their overall objective, or because corridor development will require tremendous investments in public infrastructure that they are not willing to commit.

## **2.2 Approach of Previous Research Studies**

Previous case studies on the socioeconomic impacts of urban freeways generally can be categorized either as macro-oriented or micro-oriented. The macro-oriented studies were concerned with the effect of the urban freeway system on overall metropolitan growth as it relates to other metro areas, and on the distribution of activity within the metro area. The micro-oriented studies dealt more with traffic patterns, land use and property value issues in the vicinity of the freeway. National studies indicate that in relation to property value issues, business, industry and apartments typically benefit from freeway proximity, especially if the activity can benefit from freeway accessibility and visibility and can tolerate noise, air, or pedestrian safety problems that make freeway sites unsuitable for some activities such as detached housing.

The research studies generally used one of two primary methods to analyze the impacts of urban freeways. The first method is comparative statistics. Data are gathered for a test area along the urban freeways and summary statistics are prepared. For example, if a residential neighborhood was being analyzed, housing prices would be normalized, controlling for square footage and features such as swimming pools. Similar information is gathered for a control neighborhood that is similar in character to that in the subject area. Differences between the two sets of statistics are then analyzed with an attempt made to attribute a portion of the difference to the freeway. Historical studies are used, comparing changes over time in historical growth rates, land value, and land use before and after freeway construction. In reviewing previous empirical studies, some issues that are worth mentioning include the scarcity of relevant data, and the limited effort in the longitudinal studies which assess the impacts from the three time dimensions: before, during, and after the construction of the freeway.

In many of the macro-oriented studies, differences in rates of growth between areas with an urban freeway system and areas without a freeway system were analyzed, and a portion of the difference was attributed to the existence of the freeway system. Attribution is by far the most difficult issue. In many cases, changes are considered net additions or net benefits to the metropolitan area as a whole, when in fact the change may represent a redistribution of activity within the metropolitan area. These rates of growth are differentiated among areas due to the proximity and accessibility effects of freeway. Since the two variables are more likely to be indicative of the socioeconomic impacts of freeway development, the research questions that need to be addressed would be centered around them. In this framework, they will cover the analyses of property value, land use, commercial/industrial, and urban development impacts.

The second major approach that is utilized is primary survey. This approach involves a systematic survey of factors influenced by the urban freeway and involves a survey of residents and businesses within the area to determine likely behavioral responses to freeway construction. This approach is particularly helpful to assess the impact of the freeway on travel decisions and worker location decisions. In these types of studies, the origin and destinations of particular travellers are required to properly assess the impact on behavior. A survey is also required to assess the impact of freeways on attitudes and social well-being issues.

### **2.3 Findings of Previous Research**

Conceptually, the social and economic impacts of freeway development separate obvious effects directly caused by right-of-way acquisition and displacement (direct impact) from indirect impacts triggered by freeway construction. Substantial documentation has been published on the direct impacts of highway-related activities and the compensation issue. The indirect impacts change the relative attractiveness of a neighborhood adjacent to the freeway (positively or negatively) to present and potential users of the neighborhood. The effect is commonly measured by "attractiveness" indicators. In this regard, the attractiveness measures are indicated by property value, land use pattern, business composition, and pattern of urban growth.

The analysis of actual development patterns and property values are more likely to be indicative of the socioeconomic impacts of the freeway construction program since

the factors that will be analyzed represent the results of actual market forces and behavior. The analysis of those four impact indicators will not only show the benefit of freeway development (positive attractiveness) but also the cost of freeway construction as well (negative attractiveness). The next sections review literature on the impact indicators as they relate to the development of freeway construction. The findings of research conducted in other areas provide a good foundation to develop the research plan to assess the impacts of urban freeways in Arizona.

### **2.3.1 Urban Form Impacts**

There is a substantial amount of literature related to the interaction of transportation systems and employment and land use development. Although there is not one accepted theory about this interaction, the common thread is that both people and businesses will tend to locate in a way to minimize transportation cost, assuming all other factors equal.

In terms of residential location, people will trade off housing costs and commute costs. Commute costs include both out-of-pocket expenses and travel time. As commute costs increase, people want to pay less for housing. Thus, we see land costs and housing prices lower on the periphery of an urban area where commute costs are higher than for closer-in locations.

The business location decision is affected in much the same way. A business will tend to choose a location that strikes a balance between total transportation costs and land prices. This trade-off will be much different for different types of businesses for two primary reasons. First, the composition of transportation costs will vary depending on the type of business. A manufacturing company will weigh the costs of transporting raw material to the plant and the costs of transporting the finished product to market against land values. An office user may weigh the commute costs of employees (since the availability of quality labor is required) against the value placed on being in a business hub such as a downtown area. A retailer will trade off the commute times of his customers with land prices to determine the best location.

The addition of an urban freeway system changes the travel time, which changes commute costs and the relative accessibility of each point in the urban area. For the resident, reduced commute times, which translate into lower journey-to-work costs, mean that he can consume more "housing" or some other good. Changes in residential

patterns have been easier to identify than employment locations in other urban areas and have been more pronounced. This may be due to the fact that the residential segment of the market is more mobile than the employment segment due to lower per unit capital costs, it can internalize and react to such changes more quickly, and this market segment may have fewer ties to a given area.

Changes in employment locations are more difficult to isolate because of the lack of good subcounty employment data coded by place of work. Businesses usually represent higher capital investment in both land and structures. In addition, a business will tend to have significant value built-up in a given location in terms of market presence which will make it more reluctant to move to a new area. New businesses will also tend to locate in areas that have demonstrated success, or that have a concentration of similar types of businesses, or that project an image that is necessary for the new firm. For example, it would be unusual for a bank headquarters to be located outside of a financial district.

In the literature, the patterns of geographic distribution of population and employment indicate that in contrast to patterns of population distribution which are generally continuous, employment tends to concentrate in a relatively limited number of well-defined business areas. In the last few decades, diversified land use concentrations comparable with downtown in their range of functions developed in the form of clusters and corridors. In the Washington, D.C. area, the suburban regional employment centers employed almost half as many people as worked downtown in 1974. This area has few major differences with most other urban areas: the dominance of government employment and the concentration of regional employment in the central area. Because of the much higher relative importance of the central employment core in Washington, D.C., it is likely that other regions will contain more and larger suburban employment centers, and that the cumulative employment in such centers would exceed that of the downtown.

Many factors affect land use patterns in these concentrations, including land use regulation, historical factors and timing of development, local opportunities for annexation, and characteristics of transportation systems. Any examination of suburban clusters and corridors invariably emphasizes the importance of transportation system. Much of the literature indicates that freeway configuration has a significant impact on the spatial distribution of clusters and corridors. Because circumferential freeways offer

greater access to larger parts of the metropolis than do radial freeways, clusters and corridors usually are more intensively developed along beltways.

It is general knowledge that while central city jobs have been declining, suburban employment is rising. In 1975 in Denver, for example, the downtown's share of total regional employment was declining by 40 percent and is still expected to decline by 25 percent in the year 2000, despite major public efforts to curb this exodus. Suburbanization of employment in urban areas has reduced the significance of downtown not only for shopping but also for commuting. Recent statistical analyses for 25 large metropolitan areas suggest that the number of public transportation commuters is very closely related to the number of Central Business District (CBD) employees rather than to overall metropolitan size. In other words, the decline of transit commuting is largely due to the reduction of CBD employment.

Obviously, the desire for certain characteristics in housing units and neighborhood is not a function of freeway impact alone. However, for families with young children, the presence of a freeway significantly increases the desire to move. In low-density areas, primarily in suburbs, the physical impact of the freeway is mitigated by the dispersion of the residents. It is the accessibility of other parts of the metropolitan region, particularly the downtown area that marks the influence of a freeway in such tracts.

Communities are becoming more and more concerned about so-called "concomitant outputs," such as the tangible and intangible effects of the freeway system on society and the environment than about "performance outputs," such as changes in travel times, volume, costs, and other objectives of the transportation system. The concomitant outputs dictate the quality of life of neighborhoods affected by freeway construction. Major components of quality of life indicators include economic, education, social, and environmental factors, as well as mobility and accessibility. It means that the assessment of neighborhood quality of life is aimed at finding if the freeway system enhances economic vitality, greater mobility and better accessibility, higher educational attainment, and enriches socioenvironmental conditions.

Completion of the freeway system in metropolitan areas has opened a wide variety of locational options for urban land use. Employment centers in the form of new office sites have been prominent among these developments. A study analyzing the attraction



of freeway systems for new employment centers in seven metropolitan areas (Atlanta, Dallas, Denver, Louisville, Minneapolis-St. Paul, Omaha, and San Jose) showed that greater growth of new office sites occurred outside the downtown core than in it. Growth of office space averaged 24 percent in the core and averaged 207 percent in non-core areas. Growth of office space along freeways exceeded growth in all other non-core transportation corridors.

In summary, the review of previous research has revealed that urban freeways can increase development opportunities along the corridor and can reinforce prevailing development patterns. Freeways alone, however, are not a sufficient inducement to counteract an area's poor image or to create a market for land, housing, or commercial space where none has historically existed. Previous case studies found that the greatest amount of suburbanization occurred in metropolitan areas that did not have a beltway system even when compared to metro areas that had a beltway.

An urban freeway location has shown to be a positive influence on multifamily housing, however, single family residential patterns rarely are affected over the long run. The impact of freeways on residential development and on commercial and industrial land use is described below.

### **2.3.2 Land Use Impact**

Freeway developments affect opportunities for social and economic activities by increasing the number of alternative sites where it is feasible to work, shop, or relax. This increases the options open to people using the freeway system. Accessibility advantages of freeways are often demonstrated in development patterns of land uses. A USDOT study has shown that areas affected by freeways have often experienced more industrial development than comparable areas without freeway developments. Business, industry, and apartments benefit from freeway proximity and are more tolerable to noise than single family houses. This conclusion implies that proximity is not the only determining factor of land use development.

As mentioned above, the presence of an urban freeway is not sufficient by itself to create a development market where none has existed. In a similar way, a freeway is viewed as an important factor in the location decision and land use change, but it is not the only factor. For example, freeway interchanges are favored as a location for a regional shopping development, but previous studies indicate that many would have been

built in a suburban area even without the freeway. Freeways do, however, appear to affect the timing, location, size, and initial success of regional centers, but are not critical in determining their overall feasibility.

Industrial and office developers are willing to pay a premium for corridor locations with accessibility and visibility from the freeway. However, previous studies indicate that the freeway is less important than the availability of land and a skilled labor force. In most communities, industrial sites with rail access were preferred over freeway sites.

The nature of a circulation system in an area close to freeway affects the area's form and development. A Minneapolis study indicates that where frontage roads are present and have easy access to and from the freeway, all sites fronting on the freeway are desirable, especially for commercial activities and lodging industry. If frontage roads are absent or have restricted access, development is concentrated around interchanges. This illustrates how local comprehensive plans might influence land use impact of freeways.

The timing of freeway construction relative to the development of adjacent land is also important in the land use impact analysis as shown by the Minneapolis study. The study shows that if adjacent land is developed before the freeway is built, little land is left for any freeway-oriented development, and only small clusters will form at major interchanges. If the freeway is built long before the adjacent land is improved, clustering at interchanges again will predominate, with development along the freeway between interchanges only as spillover from the clusters. Since the Minneapolis study was aimed at the analysis of land use patterns of businesses impacted by freeway systems, little has been said about the pattern of growth of residential areas.

Freeway development is largely a capital investment program. The financial consideration suggests that most freeways are commonly constructed in lateral or longitudinal stages. In the case of lateral stage construction, service roads are constructed and opened to traffic before the main lanes. In the case of longitudinal stage construction, the service roads or main lanes are constructed on a freeway section-by-section. The analysis of actual land use changes in Houston, Texas, reveals that residential land use is the most sensitive type of land use to staging freeway construction. Commercial and industrial development are also sensitive but with lower

magnitude. The impact of freeway construction scheduling on multifamily land use is much smaller.

### 2.3.3 Property Value Impact

One of the impacts that is of great concern to the public is the effect of an urban freeway on property values. A Seattle study indicates that where improvement in the accessibility of an area was substantial, property values appreciated significantly. The study showed that in Kingsgate, Interstate 405 resulted in a 12 percent appreciation. In the North King County, the appreciation that resulted from I-5 was 15 percent. In both areas, most residents used the freeways for commuting to work and realized significant time savings. On the other hand, in the control area there was little or no effect of freeway benefits on property values. For commercial and industrial property, values were found to have appreciated almost 17 percent more in the freeway impact area than in the control area.

Some of the properties closest to the highways also suffer some negative effects because of adverse environmental influences. Highway noise levels caused a partly offsetting decrease in property values for those houses closest to the highway. In the Seattle study, the magnitude of this adverse effect ranged from 0 to 7.2 percent, depending on the noise level and the character of the neighborhood involved. The study found that the impact was greatest in higher income neighborhoods.

The net effect on property values was positive for the areas where both effects could be quantified. This implies that all properties in the areas appreciated because of the freeway, but those closest to the freeway did not appreciate to the same extent. A study for North Springfield, Virginia estimates that the difference in sales price between properties in proximity to the highway with those equivalent properties located farther from the highway was \$3,000 to \$3,500.

A study in Canada indicated that levels of noise from highway traffic (up to 73 dBA) are not related to major differences in housing prices. Levels of 60 to 65 dBA have been shown to be associated with annoyance but appear not to affect housing prices. High sound levels (above 73 dBA) are necessary if housing prices are to be significantly affected. For high noise levels, the cost of noise appears to be roughly \$650 to \$700 per decibel, at 1977 prices.

A similar study in Virginia shows that housing prices appear to be influenced by noise level above 63 dBA (in Northern Virginia). For a house experiencing more than 63 dBA, the estimated reduction in price would be \$94 per decibel, at 1978 prices. In Tidewater, Virginia, the influencing noise level was above 70 dBA, and the reduction in price was estimated to be \$88 per decibel.

#### **2.3.4 Impact on Businesses**

The spatial pattern of businesses is a cumulative product of decisions made at particular sites. The impact of freeway construction on the location of business developments takes the corridor form of land use developments. Corridors are linear, activities string out along an axial freeway with most growth in the two directions along that artery. An analysis of factors theoretically associated with this land use concentration in seven metropolitan areas (Atlanta, Dallas, Denver, Louisville, Minneapolis-St. Paul, Omaha, San Jose) suggests that accessibility to the residences of white-collar workers, especially those who make decisions on business location, was most important.

The steady suburbanization of housing and retail activities in most metropolitan areas further reinforces the trend toward decentralized business location. An analysis of suburban office growth in several U.S. cities indicates that these businesses include many of the nation's most rapidly growing industries, such as service-oriented companies (data processing and research) and technologically-sophisticated firms (manufacturers of computers, precision instruments, and electronic components). There is also a clear trend towards mixed-use suburban congregations; the activities found at some multi-complex centers read like an inventory of traditional downtown facilities.

The types of locales preferred by different activities vary considerably. The findings from two case studies in Minneapolis-St. Paul show businesses are strongly attracted to corridor development. The strongest desire for easy access to freeways leads many industrial plants and warehouses to locate in corridors, as does the need for large tracts of less expensive land on which to construct efficient, one-story facilities with ample space for freight transfer and employee parking. Commercial establishments as a group have great geographical tolerance, and they are found in a wide range of locations. However, not all commercial activities want or can afford cluster locations (a cluster is an areal form, focussing on one or more nuclei). Automobile dealers like to be near one another, but their space requirements force them to highly visible sites on

cheaper land in corridors. The locational criteria of hotels and motels lead them to locate in both types of concentrations, clusters and corridors.

The Minneapolis-St. Paul study concludes that no absolutes govern the geographic behavior of business land uses, but their locational tendencies indicate that a corridor is formed by the coalescence of activities around its interchanges. Commercial activities group around interchanges with roads that serve residential areas; hotels and motels are attracted toward airports and interchanges with other freeways. Industrial and wholesale operations are the mainstay of the corridor and occupy large tracts not desired by other land uses. Office buildings are found throughout the corridor; these frequently fill in gaps between interchanges that are not commercially desirable.

#### **2.4 Business and Residential Perceptions of Freeways**

A freeway can be interpreted as a physical entity and/or a transportation facility. The former refers to the road as a physical intruder that necessitates demolition of housing and relocation of population, creates barriers to movement within neighborhoods, increases traffic around access and egress points, and generally pollutes the physical environment. The freeway as a facility is a carrier of goods and population that provides access between different zones of the metropolitan areas.

An analysis of the relationship between population density and freeway impact for 23 SMSAs in 9 states indicates substantial differences between affected and unaffected tracts in high-density tracts but not in the low-density stratum. The differences in the high-density tracts, however, were not necessarily attributed to the freeway. How does one account for the different patterns and magnitude of impacts between high- and low-density strata?

In the high-density tracts where the physical aspect of the freeway predominates, sensitivity to the road as a physical object would be greater. Local lower income and greater pedestrian dependency (more children walking to school), and more use of local neighborhood shopping facilities all contribute to the likelihood that a new freeway will disrupt normal transportation routes (force people to take detours). The more densely populated an area is, the greater the physical intrusiveness of any freeway construction project can be expected to be. It is not uncommon that families whose children are approaching school age have a tendency to seek suburban, single family housing and

open space. Once children begin to venture out alone, the quality of neighborhood becomes more important to the parents. There has been a body of research that points out the importance of quiet, traffic-free streets and general environmental qualities in conditioning feelings about a neighborhood.

## 2.5 Research Focus

Thus, previous research provides a strong theoretical foundation, supported by previous case studies, for the analysis of urban freeway impact in Arizona. The literature strongly emphasizes that each metropolitan area is unique, and that freeways in and of themselves only create opportunity, but change depends on a larger number of factors.

Phoenix is unique in the combination of its very rapid rate of growth, its low-density development that contributes to a rapid physical expansion of the urban periphery, and its extremely limited freeway system. Maricopa County's planned freeway system introduces a significantly new factor into the urban area's future development. Its implementation will create freeway corridors in both urbanized areas and in the undeveloped periphery. Moreover, the addition of 230 miles of freeway system to the urban network (compared to only 80 miles that are currently in place within the urban area) will substantially alter the supply/demand balance for freeway corridor property.

There are a number of areas that are explored in this document.

- What is the demographic impact of freeways?
- What are the land use impacts of freeways?
- What are the impacts on residential development?
- What are the impacts on residential property values?
- How do people living closely to a freeway perceive it?
- What are impacts on business?
- How do freeways affect urban form?

The chapters that follow present findings on the metro Phoenix case study areas, relating them back to the broader foundation provided by the literature.

### 3.0 Study Area Description

Based on consultation with the Arizona Transportation Research Center, portions of two freeways within metropolitan Phoenix were selected as case studies for this research project: the Superstition Freeway (Arizona 360) from its junction with Interstate 10 in the City of Tempe to Gilbert Road in the City of Mesa; and the Black Canyon Freeway from McDowell Road to Bell Road in the City of Phoenix. These two freeway corridors were selected because of their differences.

- They were built at different times, completed over a period from 1958 to 1981.
- They included a range of urban areas that, on one extreme, were almost completely urbanized older areas and, on the other extreme, were undeveloped agricultural land.
- They were built in different cities.

Based on a review of the literature on freeway impacts, two types of Study Areas were defined for each of the freeway corridors:

1. A study area was defined to include a segment three miles long, extending 1-1/2 miles on either side of the freeway. As Figure 3-1 shows, a study area was divided into three smaller areas:

- a sample area, defined to be one-half mile on either side of the freeway, and
- two control areas that extended beyond the sample area for one mile.

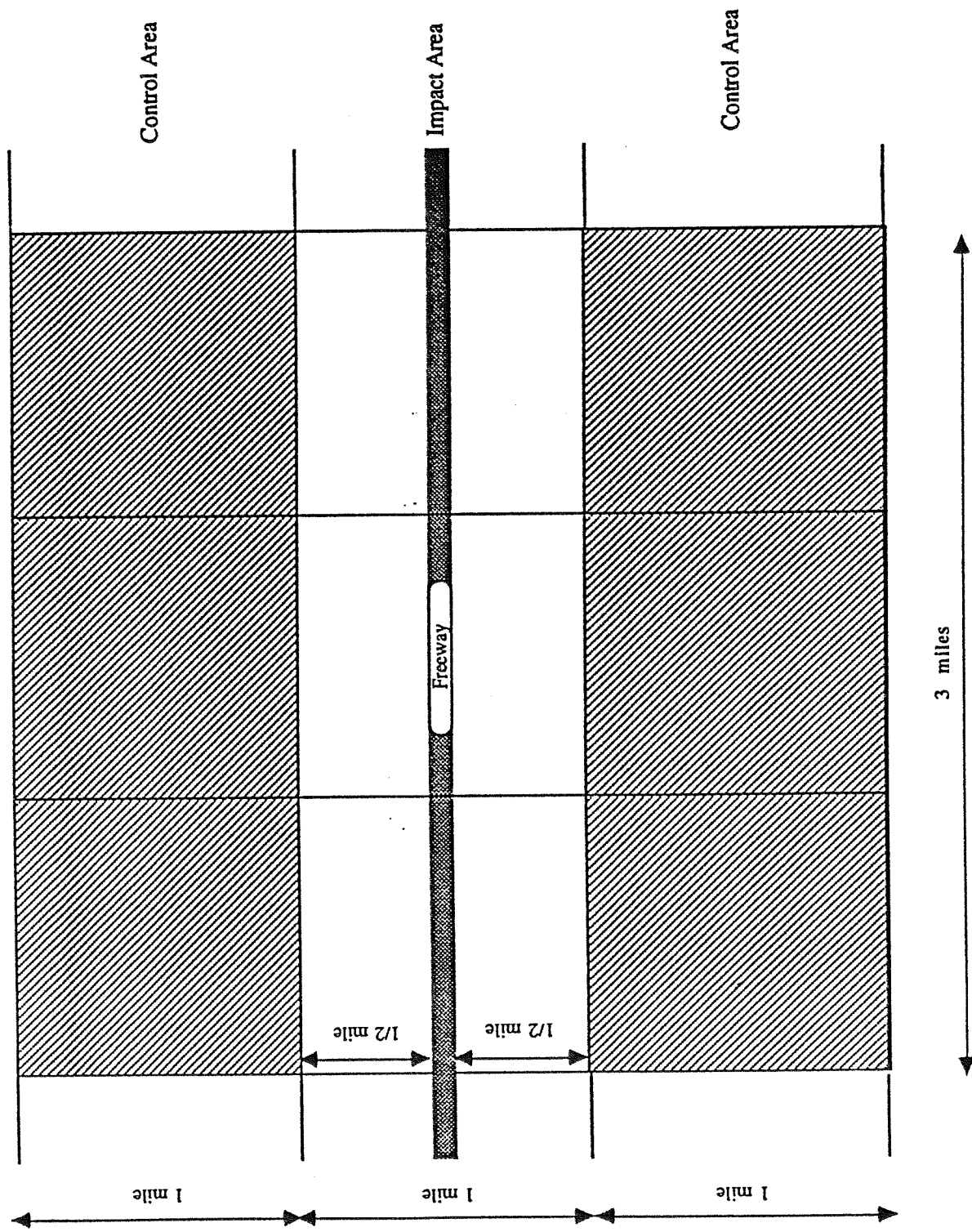
The purpose of the control areas is to serve as areas against which the activity within the sample can be compared to determine the impact of the freeway.

2. The second type of area defined was a freeway study corridor (see Figure 3-2). A freeway corridor is defined to extend one-half mile on either side of the freeway and runs from 10 to 12 miles along the freeway. The corridors are used for more intensive land use analysis than the smaller study areas.

A study corridor is further categorized into three areas which provide different locational opportunities.

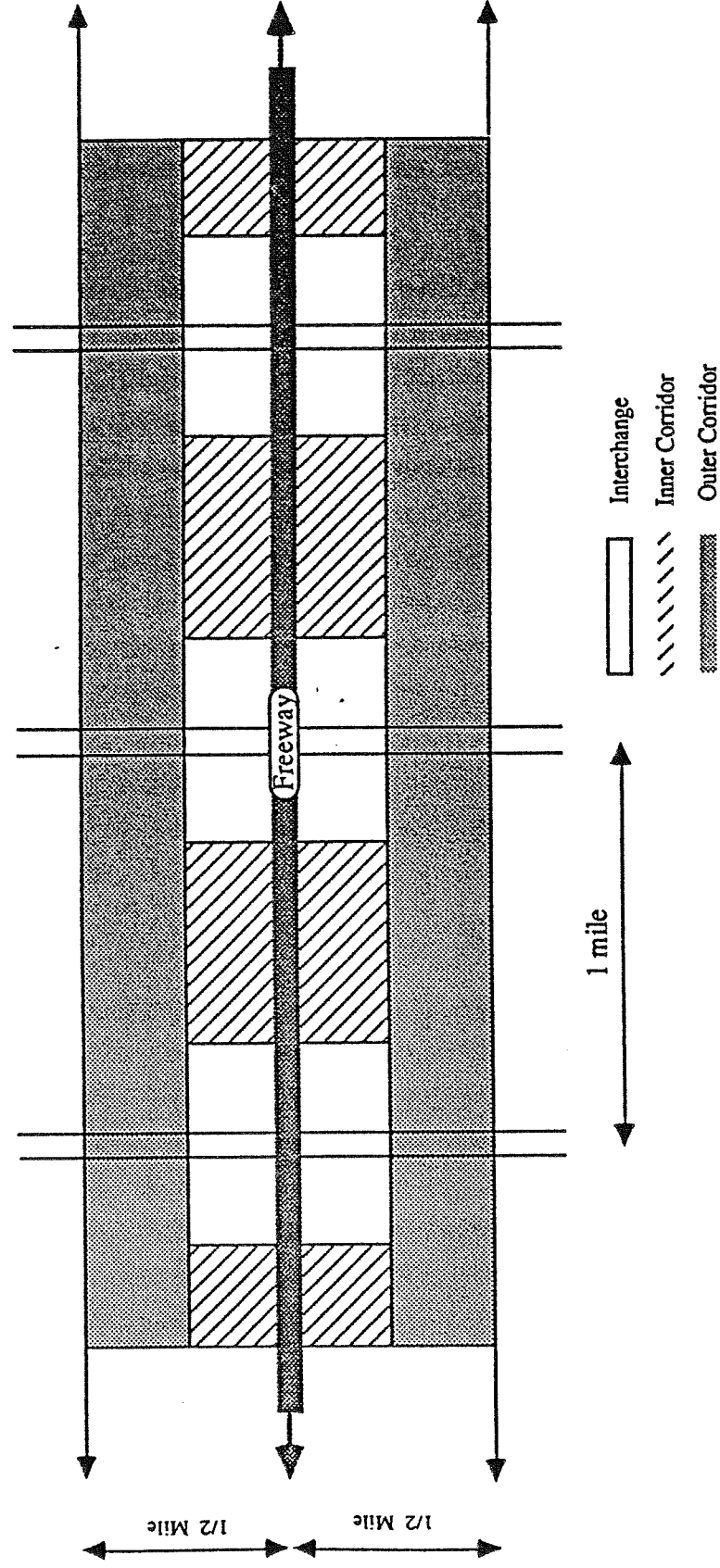


FIGURE 3-1  
FREEWAY STUDY AREA STRUCTURE



Source: Economic Research Division, Mountain West Research, July 1987.

FIGURE 3-2  
FREEWAY STUDY CORRIDOR STRUCTURE





- The interchange consists of a one-half mile square area centered around each freeway-arterial interchange, extending one-fourth mile from the interchange in all directions.
- The inner corridor consists of a one-half mile parallel strip, extending one-fourth mile on either side of the freeway, that connects interchanges.
- The outer corridors are two one-mile by one-fourth mile strips, running parallel to the freeway adjacent to the interchange and inner corridor areas.

The literature indicates that the majority of freeway-related impacts will be found in a zone contained within one-half mile of the roadway, which precisely defines the study corridors. Each of the wider Study Areas, however, is further distinguished into "Impact" areas within one-half mile of the roadway and "Control" areas that extend from one-half to one-and-one-half miles from the roadway. This distinction is drawn in order to better isolate freeway-related impacts. The choice of study areas was largely based on this attribution issue--the timing and general character of land uses in their control areas was similar to those of their sample areas at the time the freeway was constructed. Thus, within metropolitan Phoenix, four distinct areas were identified. As Figure 3-3 shows, these include:

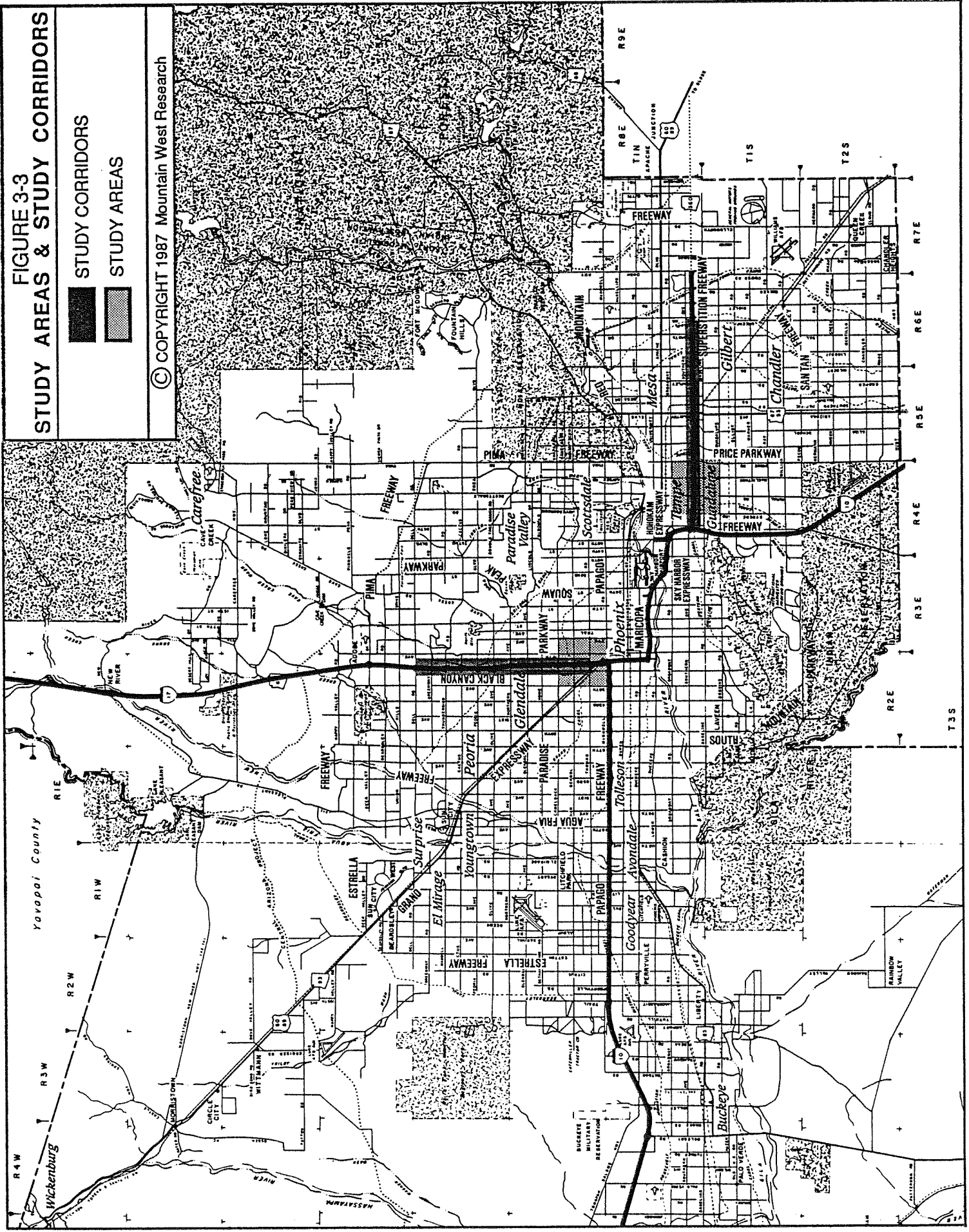
1. The Superstition Study Area
2. The Black Canyon Study Area
3. The Superstition Study Corridor
4. The Black Canyon Study Corridor

The Superstition Freeway Study Area is bounded by the Southern Pacific Railroad on the west, Price Road on the east, Broadway Road on the north, and Guadalupe Road on the south. The area is completely contained within the City of Tempe. The one-mile strip along the freeway from Southern and Baseline is defined as "impact area" and the remaining sections are defined as "control areas" (see Figure 3-4). Control Area North is contained between Broadway Road and Southern Avenue, while the Control Area South is contained between Guadalupe Road and Broadway Road. Where more detailed assessment is necessary, both Impact and Control Areas were further distinguished into smaller "neighborhoods".

**FIGURE 3-3**  
**STUDY AREAS & STUDY CORRIDORS**

-  STUDY CORRIDORS
-  STUDY AREAS

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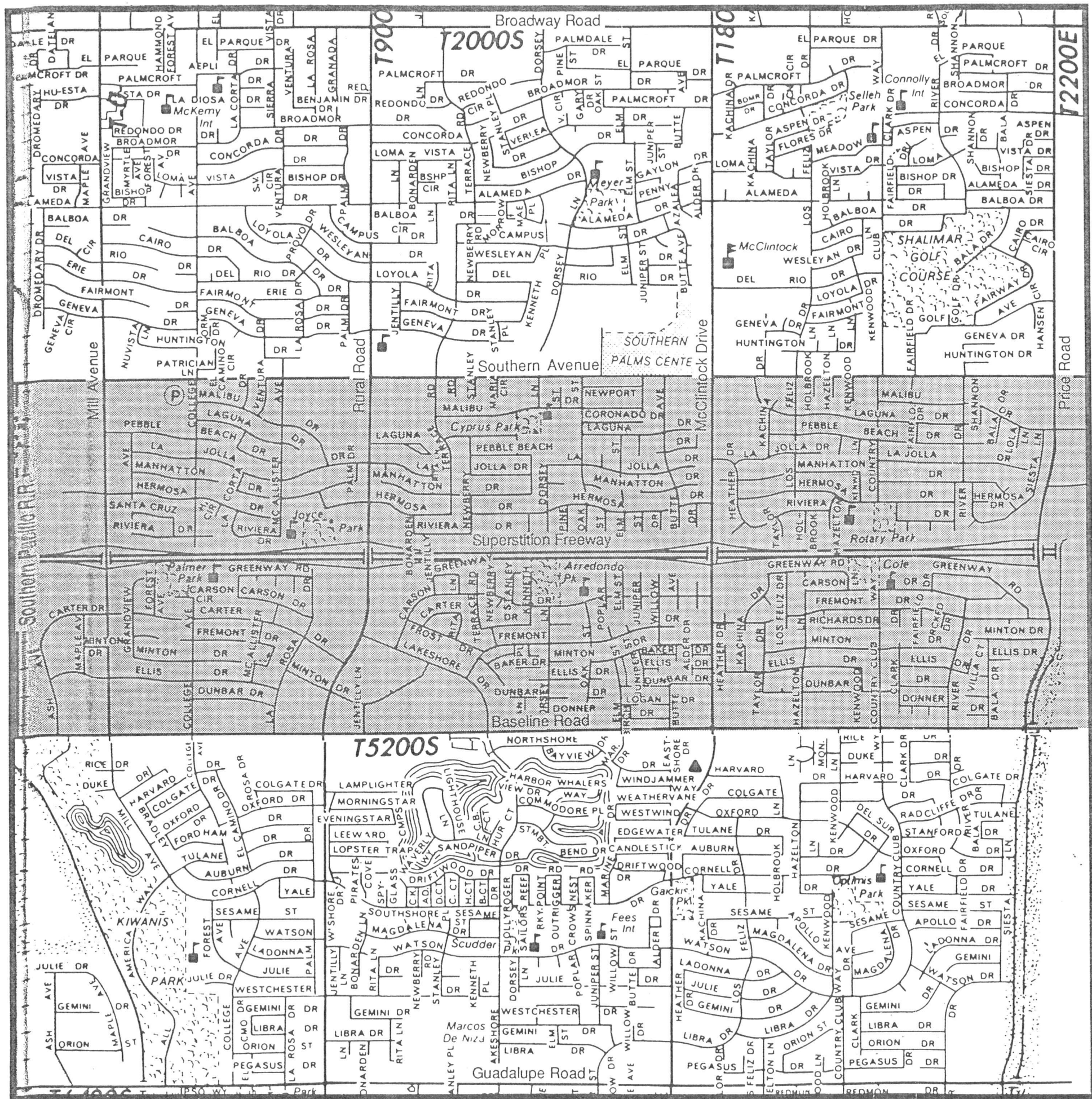


FIGURE 3-4

# SUPERSTITION FREEWAY STUDY AREA

- SAMPLE AREA
- CONTROL AREA

The Black Canyon Study Area is a corridor of I-17 bounded by 35th Avenue on the west, 7th Avenue on the east, Camelback Road on the north, and McDowell Road on the south. The area is under the jurisdiction of the City of Phoenix. This study area was chosen because its freeway was built in an already urbanized area. The Black Canyon area was built in the late 1950s and completed in the early 1960s. It is a depressed freeway. The Black Canyon "Impact Area" is defined as a one-mile strip along I-17 from 27th Avenue on the west to 19th Avenue on the east, and from Camelback Road on the north to McDowell Road on the south (see Figure 3-5). The Control Area West is bounded by 27th Avenue and 35th Avenue. The Control Area East is bounded by 19th Avenue to 7th Avenue.

The Superstition Freeway Corridor runs from milepost 0.0 (at 56th Street, Tempe) to milepost 10.0 (at Gilbert Road, Mesa) along the S-360. The corridor covers a 1-mile wide area, so that the size of Superstition corridor study area is 10 square miles. A total of 40 smaller segments were defined in the Superstition Corridor. Most of the sections were developed after the freeway was constructed, except for a very few sections at the western edge of the corridor. Forty percent of the corridor is in Tempe, and the remaining segment is located in Mesa.

The Black Canyon Corridor starts at McDowell Road and ends at Bell Road. The one-mile corridor runs for 12 miles. A total of 48 smaller sections were defined in the Black Canyon Corridor, all located in the City of Phoenix.



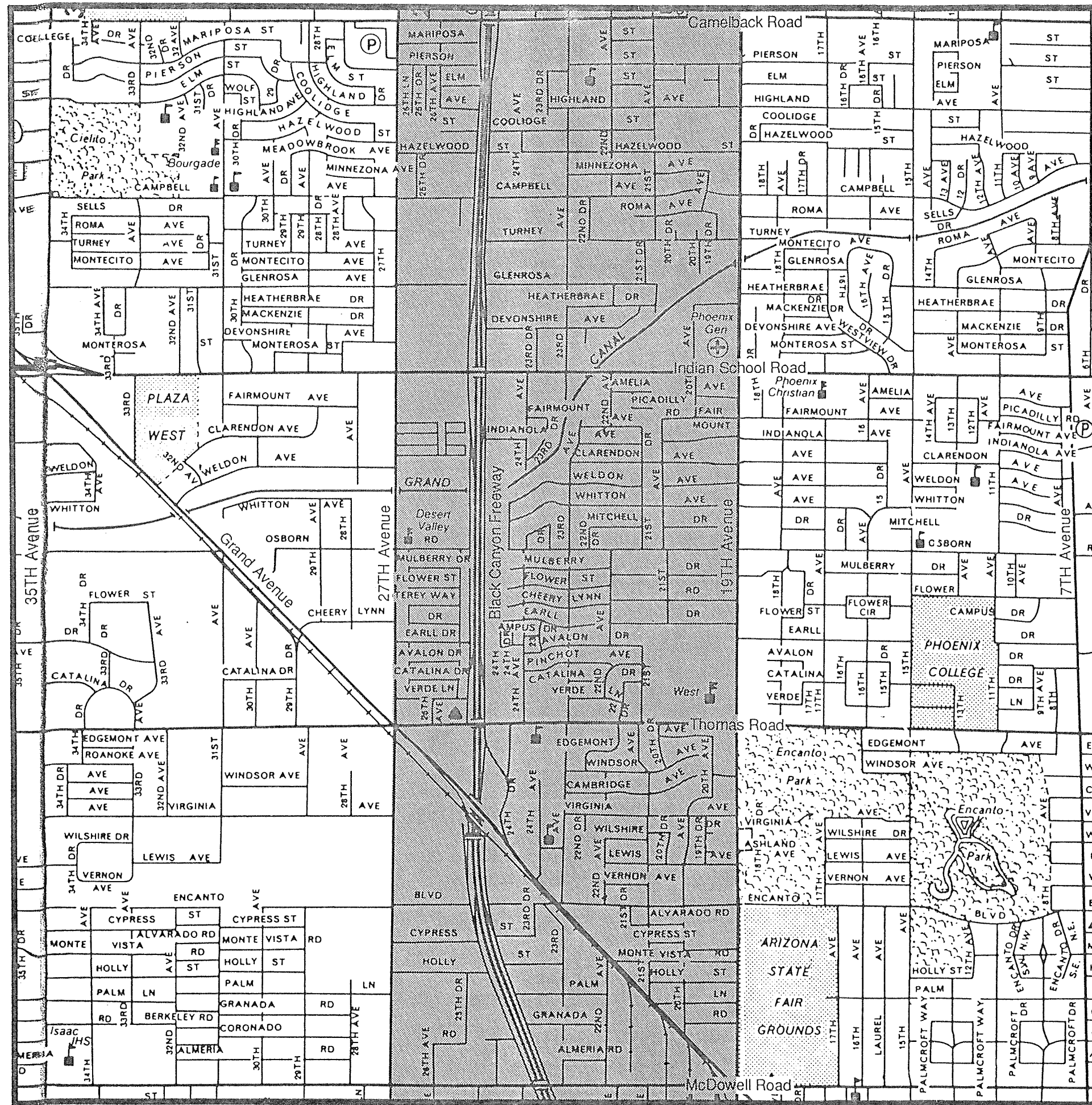


FIGURE 3-5

## BLACK CANYON STUDY AREA

- SAMPLE AREA
- CONTROL AREA